In the specification:

Please amend the paragraph beginning at page 1, line 19, as follows:

To produce a flow measurement, the flowmeter first determines the vortex shedding frequency, ω_{v_2} in rad/sec. The flowmeter also converts the reading into a flow, f, in units of l/sec, through use of $f=K_m\omega_v$, where K_m is the appropriate meter factor. This meter factor K_m (or K-factor) relates the frequency of generated vortices to the flow rate.

Please amend the paragraph beginning at page 4, line 29, as follows:

Based on the lock indicator signal, an output of the signal processor may be switched ~~from~~ between an output signal produced by the first PLL and an output signal produced by the second PLL. Switching the output of the signal processor includes switching the output of the signal processor from the output signal of the first PLL to the output signal of the second PLL when the lock indicator signal indicates that the second PLL is locked into the frequency of the input signal. Additionally, the output of the signal processor may be switched from the output signal of the second PLL to the output signal of the first PLL when the lock indicator signal indicates that the second PLL is out of lock with the frequency of the input signal.

Please amend the paragraph beginning at page 20, line 20, as follows:

The switching mechanism 1216 can be designed to take the measurements (frequency estimate θ_1) of PLL1 1212 during start-up of the vortex flowmeter and during transients. When the flow rate is constant or varying with small slew-rates, however, the switching mechanism 1216 can take the measurements (frequency estimate θ_2) of PLL2 1214 and hence give a more accurate estimate of the flow rate. The switching conditions can be achieved by a careful design of a lock-indicator LI2 of PLL2 1214, so that, for example, LI2 indicates a signal '1' if PLL2 1214 is locked and '0' when PLL2 1214 is out-of-lock. The lock indicator LI2 may be designed to be slow and sure to indicate lock-in but fast in deciding that PLL2 1214 is out-of-lock. Moreover, once LI2 indicates lock, the switching mechanism 1216 can switch the center frequency of PLL2 ~~1216~~ 1214 to a fixed value $\bar{\theta}_0$ (i.e., $\bar{f}_0$).

Please amend the paragraph beginning on page 22, line 16, as follows:

To overcome this problem, a dual PLL 1510 using an amplitude detector 1512 to control a prefilter 1514 may be used, as shown in Fig. 15. The dual PLL 1510 comprises the PLL1 1212, the PLL2 1214, and the switching mechanism 1216 introduced in Fig. 12. The prefilter 1514 may be implemented as a band-pass filter having a high cutoff frequency f_{ph} (Hz) and low cutoff frequency f_{pl} (Hz). The amplitude detector 1512 may switch on the prefilter 1514 if the measured amplitude $\hat{A}$ is below a threshold (user-controllable) amplitude $\overline{A}$, and may switch off the prefilter 1514 if the measured amplitude $\hat{A}$ is above a threshold (user-controllable) amplitude $\overline{A}$. When the prefilter 1514 is switched on, the prefilter filters the input signal before the input signal ~~it~~ is input to the PLL2 1214. When the prefilter 1514 is switched off, the input signal is input to the PLL2 1214 unfiltered.

Please amend the paragraph beginning on page 24, line 15, as follows:

The design of the switching mechanism 1216 may consider the following two issues. First, the natural frequency ω_{n1} of PLL1 1212 may be selected to <u>be</u> large enough to ensure lock-in of PLL2 1214 despite a noisy center frequency θ_1 (which is the frequency estimate from PLL1 1212). Second, the effect of the noise in θ_1 on the frequency estimate θ_2 may be taken into consideration.

Please amend the paragraph beginning on page 26, line 11, as follows:

Fig. 17 illustrates an implementation of the switching mechanism 1216 introduced in Figs. 12 and 15. Switches S1, S2 and S3 combine to output the frequency estimate of the dual PLL 1510 as well as the center frequency θ for PLL2 1214. For example, S1 provides the frequency estimate θ_1 of PLL1 1212 as the center frequency θ of PLL2 1214 when LI2 is "OFF". When LI2 is "ON," S1 outputs a fixed center frequency $\overline{\theta}$ (i.e., $\overline{\theta}$ is fixed at its last value). S2 outputs the frequency estimate θ_2 from PLL2 1214 if LI2 is "ON" (constant flow-rate). Otherwise, S2 outputs the frequency estimate θ_1 from PLL1 1212 (e.g., during start-up and large slew-rate transients). S3 takes the output from S2 if the amplitude of the vortex shedding

exceeds the threshold value $\overline{A}$. If the measured amplitude $\hat{A}$ is below $\overline{A}$, however, S3 outputs the frequency estimate θ_2 from PLL2 1214, because PLL2 1214 has a fixed center frequency $\theta=2\pi f_{ph}$ and the prefilter ~~1512~~ 1514 is switched on.

Please amend the paragraph beginning on page 28, line 8, as follows:

It is sufficient to use a low noise analysis, as prefilter ~~1512~~ 1514 is used to filter out the noise in low flow rates, and hence high SNR is input to PLL2 1214. Accordingly, when the PLL is out-of-lock, the noise $n_f(t)$ is very small compared to $A_0|G(j\Delta\omega)|/4$, and the second harmonic signal is reduced significantly by the low-pass filter 1812 due to the heterodyning, so both noise elements can be neglected when the PLL is out-of-lock.

Please amend the paragraph beginning on page 30, line 16, as follows:

Accordingly, a further implementation of the lock indicator (LI2) may follow the design of being slow and sure to indicate lock but fast in deciding that the PLL2 1214 is out of lock. Referring to Fig. 23, this design may be implemented by adding components to the lock indicator 2300. As shown, the output of LI2 (the output of the relay 1814) passes through a hit crossing 2310. The hit crossing 2310 signals that LI2 is out of lock when the output of the relay changes from an ON state (i.e., 1) to an OFF state (i.e., 0). Once the hit crossing 2310 indicates that LI2 is out of lock, a switch 2312 saves in a memory 2314 the time t_1 when the hit crossing 2310 is ON, which is provided by the clock 2316. A switch 2318 works to keep the output of LI2 zero (by outputting, for example, a "0" signal controlled by a constant module 2320) for a time t_d, which is a design parameter controlled by a time period module 2322. Once a relational block 2324 determines that the time difference (determined by, for example, a multiplexer ~~2324~~ 2326 and a function block ~~2326~~ 2328) between the clock output t_c and t_1 is greater than the specified value t_d, the output of LI2 may be simply the output of the relay 1814.

Please amend the paragraph beginning on page 39, line 3, as follows:

The vortex flowmeter may ~~use~~ be used in a control system that includes self-validating sensors. To this end, the vortex flowmeter may be implemented as a self-validating meter. Self-

AG end

validating meters and other sensors are described in U.S. Patent No. 5,570,300, entitled "SELF-VALIDATING SENSORS", which is incorporated by reference.